Stability of Fluorescence of Sodium Salicylate*

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In a recent paper[1] Samson reported a variation with time of fluorescent yield for thin layers of sodium salicylate used to detect vacuum ultraviolet radiation. We have had occasion to investigate the stability of sodium salicylate as a VUV detector[2] independently and find, on the contrary, that the yield of this material is very stable over long periods of time provided sufficient care is taken to prevent its contamination by impurities such as vacuum pump oil which are themselves fluorescent.

Specifically, three layers approximately 1 mg/cm^2 thick were prepared by spraying salicylate dissolved in alcohol with an air brush (Ref. 2 gives details). These were put into Pyrex envelopes with quartz windows, and pumped to a pressure $< 10^{-8}$ torr with a Vacion pump. Forepumping was performed with a carefully trapped pump to avoid oil contamination from this source. Then the forepump was sealed off and the ion pump started. Initial sensitivity measurements were made at this point using a filtered, low pressure mercury arc source[3] which radiates substantially pure 2537 Å light. Fluorescence was measured with a photomultiplier. After pumping was complete,

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one tube was sealed off, subsequently opened to dry air, and then closed so it contained 1 atm. of dry air. The others were pumped continuously for three months. During this time the fluorescent yield of each tube was monitored periodically. To determine possible effects of UV irradiation on the yield, one of the evacuated tubes was irradiated with 2537 Å light from an auxiliary source giving a total dose over the test period of approximately 10^{16} photons/cm^2. In no case did the relative yields of these samples vary over the test period by more than 3% which was the estimated precision of the measurements.

One of us (A. J. T.) repeated quantum efficiency measurements in the VUV (1216 and 1610 Å) after an interval of seven months during which time the samples were stored in air in closed containers in the laboratory. No change in yield beyond the experimental limits of accuracy was detected. The VUV monochromator used in these measurements employed a liquid nitrogen trap and a cooled oil baffle on the diffusion pump to reduce oil contamination. More important, the solid state photon detector used in the measurements[(2)] was exposed in the vacuum system in very much the same way and for the same length of time as the salicylate, and this tended to reduce the error introduced by any residual oil contamination because measurements were made by a comparison method.

Samson also reported that he observed a weak maximum in the yield curve for sodium salicylate superimposed upon a gradual increase in yield at longer wavelengths, and he found the yield at 1610 Å to be approximately 14% higher than the yield at 1216 Å for his fresh samples less than one hour old. Our results, however, indicated that the yields at these two wavelengths are the same to within 1-2%. We suspect that pump oil contamination may account for the variation in yield observed by Samson, a possibility he himself suggested. Unless special precautions are taken, an oil diffusion pump will deposit a significant layer of oil in a vacuum system in a relatively short time, and unfortunately the steps necessary to prevent this have not as a rule been taken in existing vacuum UV instruments. The wavelength dependence of the fluorescent yields of common diffusion pump oils is not known well enough to be able to say whether the hump observed by Samson near 1500 Å comes from this source. It is likely that these oils have lower quantum yields than sodium salicylate, in which case gradual oil contamination of salicylate would reduce its apparent yield in time, as Samson observed.

We believe the conclusion to be drawn from these results is that considerable care should be taken to prevent contamination of sodium salicylate to be used for precision VUV measurements, but that there is as yet no reason to doubt the stability of yield of the pure material.

REFERENCES

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